

Second metacarpal midshaft geometry in an historic cemetery sample. R. A. LAZENBY, Anthropology Program, University of Northern British Columbia, Prince George, B. C., Canada V2N 4Z9

Study of bone mass at the second metacarpal midshaft has contributed to our understanding of skeletal growth and aging within and between populations, and has relied extensively on noninvasive techniques and in particular radiogrammetric data. This study reports age, sex and side variation in size and shape data acquired from direct measurement of cross-sections obtained from a large ($n = 356$), homogeneous skeletal sample. Correlation analysis and 3-way ANOVA of size-adjusted data confirms general impressions of patterned variation in this element: males have absolutely, but not necessarily relatively, larger bones than females; the right side is larger than the left, though a larger than expected proportion (ca. 25 %) of left metacarpals exhibit greater values than the right; and bone mass but not strength (in males) declines with age. Contrary to the widely accepted assumption of circularity for this location, direct measurement of cross-sectional geometry confirms previous bi-planar radiogrammetric conclusions regarding the noncircularity of the second metacarpal midshaft, and identifies a significant difference between males and females, with the latter having a more cylindrical diaphysis. Deviation of the axes of maximum and minimum bending strength associated with noncircularity suggests a distribution of bone mass to resist bending moments perpendicular to the distal palmar arch, though this conclusion awaits more robust study of the functional anatomy of the metacarpal diaphysis.

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The evolutionary significance of growth to weaning among primates. P.C. LEE, Department of Biological Anthropology, University of Cambridge, Cambridge CB2 3DZ, UK.

Inter-specific comparisons of growth to weaning across a wide range of mammals suggest that growth rates are influenced by a need to attain a metabolic threshold mass on the part of the weanling. This threshold appears to be attained when infants reach around four times their birth weight. Analysis of infant growth and lactation patterns for 40 species of haplorhine primates was carried out using regression techniques. Infant growth is proposed to be a function of the lactational capacity of the mother, which is related to maternal mass and her energetics. Rates of growth are also linked to species-specific behavioural and ecological strategies for ensuring adequate weaning mass, which appear to be sensitive to environmental risk. The capacity for varying the duration of lactation, independent of maternal mass, is an effective response to environmental uncertainty and infant mortality. Growth thus has both time and metabolic components across primate species, which affect life history patterns. Within species, there is individual variation in infant growth due to maternal condition, as a result of local ecology, and from the

social context of the mother. By determining the sources of variance in growth to weaning among species and between individuals, the evolutionary constraints and selective pressures acting on patterns of growth can be identified.

A new technique for estimating sexual dimorphism in samples of unknown sex. S.-H. LEE, Department of Anthropology, University of Michigan, Ann Arbor, MI 48109-1382.

Fossils are valuable in understanding the evolution of sexual dimorphism. However, the nature of fossils is such that sex is usually unknown. To address this problem, several methods have been proposed to measure sexual dimorphism in such a sample, where both the sex of each member and the distribution properties (mean, standard deviation) of each sex sample are not known. However, these methods, including the coefficient of variation and the finite mixture analysis, make various assumptions that are unlikely to be met in a fossil sample. Moreover, the results of the methods are sensitive to small sample size, which is almost always the case in fossil data.

This study proposes an alternative technique for estimating sexual dimorphism in a sample with small sample size and unknown sex. Applying the approach of data resampling which was used in other methods as well, it only needs to be assumed that the sample is an adequate representation of its population.

To test the new technique, eight metric variables in cranium, mandible, canine, humerus, radius, femur, and tibia were measured. Comparative data consist of samples of gorilla ($n=56$), chimpanzee ($n=46$), and modern humans ($n=91$) of known sex. For each variable, the estimate of sexual dimorphism is calculated using data resampling for each species sample, treating the sample as if the sex were unknown. Each estimate is then compared with the observed value based on known sex.

Results show that the new technique closely approximates the observed sexual dimorphism in chimpanzee and modern human samples. It slightly underestimates dimorphism in gorilla sample.

Accessory eggs, follicular atresia, and the evolution of human menopause. L.E. LEIDY, Dept. Anthropology, Univ. of Massachusetts at Amherst, MA, 01003-4805

It is widely accepted that human females produce approximately seven million oocytes (undeveloped

eggs) by the fifth month of gestation. This number declines to approximately two million oocytes at birth and 400,000 oocytes in ovarian follicles at puberty. Why, if humans require at most 450 eggs across 35 years of ovulation, are seven million oocytes produced? One suggestion has been that the over-production of eggs is an evolutionary carryover from the reproductive strategy of fish. Fish reproduction does provide part of the answer. However, questions about the over-production of eggs that treat oocytes solely as gametes to be ovulated miss a major piece of the puzzle: the adaptive value of extra eggs and the process of follicular degeneration (atresia). The adaptive value of follicular atresia is all the more important because it explains why human menopause evolved.

When the maximum potential lifespan of hominids extended beyond the age of 55, the process of atresia did not accommodate the lengthened time frame. This paper argues that the over-production of eggs and the process of follicular atresia evolved as integral to the process of sexual reproduction, and that the entire hominid somatic lifespan was more amenable to change than was the process of atresia.

Using evidence from invertebrates as well as all classes of vertebrates, this paper demonstrates that unfertilized oocytes serve critical accessory roles and that, without these "accessory eggs" or their atretic follicles, sexual reproduction in many species, vertebrate and invertebrate, could not occur. Examples range from extra eggs that provide critical sources of yolk to developing fetuses, to luteinized corpora atretica from unovulated follicles that produce the progesterone needed to maintain pregnancies. The question is not why so many eggs are produced, but what value beyond fertilization the extra eggs and their atretic follicles provide.

Morphological differentiation of gorilla subspecies. S.R. LEIGH, University of Illinois, Urbana, IL, J.H. RELETHFORD, State University of New York College at Oneonta, Oneonta, NY, and C.P. GROVES, Australian National University, Sydney.

Evidence from mtDNA suggests extensive genetic differentiation among the three recognized subspecies of gorillas (*Gorilla gorilla gorilla*, *G. g. graueri*, and *G. g. beringei*). Some have further suggested that the western subspecies (*G. g. gorilla*) should be considered a distinct species from the two eastern subspecies. Moreover, traditional craniometric studies imply major differentiation within *Gorilla gorilla*, but provide no direct insight into how this variation compares to variability within other species.

We examine genetic differentiation among these three subspecies using data on 38 cranio-gnathic variables on 409 specimens measured by CPG (*G. g. gorilla*=328, *G. g. graueri*=58, *G. g. beringei*=23). Sexes were pooled

after Z-score standardization. Genetic differentiation was assessed using Wright's FST, the ratio of among-group variation relative to panmixia, computed from metric traits using the methods of Williams-Blangero and Blangero (Hum. Biol. 61:1-12, 1989) and Relethford et al. (Hum. Biol. 69:443-465, 1997). Since heritability estimates are not available, we derived minimum FST, a useful comparative index, from phenotypic data. *Gorilla* FST values were compared to those for humans.

The minimum FST for *Gorilla* is 0.113 (s.e.=0.005). Human data derived from 57 craniometric representing three regional groups of modern humans (African, European, East Asian) return an FST of 0.065 (s.e.=0.001). Collectively, the three gorilla subspecies show almost twice the level of among-group differentiation observed within modern humans. However, relaxing the assumption of equal population sizes across *Gorilla* subspecies yields an FST of 0.069 (s.e.=0.003), virtually the same as within humans. These results suggest that *Gorilla gorilla* shows the same relative among-group variation as humans. The implications of these findings for the evolutionary histories of both humans and gorillas are discussed.

Chewing rates and feeding styles in insectivorous primates and bats. P. LEMELIN and E.R. DUMONT, Northeastern Ohio Universities College of Medicine, Rootstown, OH 44272.

Several studies have illustrated that small mammals chew at a faster rate than larger mammals (Druzinsky, 1993). These studies include data from a variety of mammalian orders and a wide range of body masses and diets. The present study investigates the relationship between chewing rates and body mass in insectivorous primates and bats to verify whether this summary model applies within a narrower comparative framework.

Chewing rates were determined from videotapes of captive individuals of primates (*Microcebus murinus*, *Mirza coquereli*, *Galago moholi*, *Loris tardigradus*, and *Tarsius syrichta*) and bats (*Antrozous pallidus*). To minimize the effect of food consistency and size on chewing rates, all subjects were fed live crickets of similar size. For each individual, chewing rates per minute were calculated by counting chewing cycles during feeding events ranging between seven seconds and one minute. Rank-order correlations between chewing rates and body mass were performed using species means for each variable.

No association was found between chewing rates and body mass within this sample. However, *T. syrichta* and *L. tardigradus* chewed at much lower rates than did other taxa. In addition, species differed in their ingestive styles. For example, while some species consumed whole crickets (e.g., *M. coquereli*), others frequently rejected various body parts (e.g., *M. murinus*). The bat also differed from the primates in its extensive use of the canines for puncture/crushing.

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The influence of acculturation and lifestyle change on the health of indigenous Siberians. W.R. LEONARD, University of Florida, Gainesville, FL 32611, V.A. GALLOWAY, University of Toronto, Toronto, ON M5T 1W5, E. IVAKINE, University of Guelph, Guelph, ON N1G 2W1, and L. OSIPOVA, Russian Academy of Sciences, Novosibirsk, Russia.

Marked declines in health status associated with lifestyle change have been shown for many circumpolar populations. Yet, while increased rates of obesity and other chronic diseases are well documented in groups such as the Inuit, the determinants of these increases are poorly understood. Reduced activity and energy expenditure are often given as the primary explanation for health changes with acculturation; however, few studies have measured these parameters in modernizing northern groups. As such the purpose of this study is to examine patterns of dietary intake and energy expenditure in an acculturating population of indigenous Siberians (the Evenki), and assess the impact of these factors on health status.

Data on body size and composition, basal metabolic rate (BMR), total daily energy expenditure (TDEE), dietary intake and general health were collected for 66 Evenki (20 males, 46 females) subjects from 3 villages in Central Siberia. Evenki men and women have similar physical activity levels (TDEE = 1.69-BMR in men; 1.64-BMR in women); however, relative to their metabolic requirements, women consume significantly more energy than men (Intake = 1.71-BMR in men; 2.24-BMR in women; $P < 0.02$). As a consequence, women are relatively heavier and fatter than men, and have higher serum lipid levels. These differences are reflected in recent increases in cardiovascular disease mortality among Evenki women in this region. Consequently, these findings demonstrate that even modest declines in physical activity, coupled with changes in dietary intake, are sufficient to explain the emergence of chronic disease patterns among acculturating populations.

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Growth as a measure of environmental stress in an agricultural and a pre-industrial community from Medieval England. M.E. LEWIS, C.A. ROBERTS, The Calvin Wells Laboratory, Department of Archaeological Sciences, University of Bradford, Bradford BD7 1DP, UK.

The differences in height between children from towns and villages have been studied since the 1870's. During this period, it was consistently found that the height of rural children surpassed that of their urban peers. However, by the 1950's this situation had changed with urban children exceeding the height of rural children by up to 2.5cm. This reversal in the trend is often attributed to improvements in sanitation, nutrition and health care in the cities after the 1900's.

Most studies on growth using non-adult skeletal remains have been carried out in the United States, and concentrate on the transition from a hunter-gatherer to an agricultural subsistence. The results have paralleled studies from the 1870's, with the agricultural sample showing increased morbidity and smaller growth curves. Despite interest in population adaptation to changing environments, little work has been done on the differences in growth between non-adults from agricultural and pre-industrial communities.

This paper presents the results of a study of 141 non-adults (0-17 years) from Anglo-Saxon Raunds Furnells, Northamptonshire (AD 850-1150) and 196 non-adults from St. Helen-on-the-Walls, in pre-industrial York (AD 1100-1600). Growth curves reveal that the height of the rural children lagged behind that of their urban peers and was significantly different (by up to 2.3 cm) between the ages of 10.6-14.5 years ($P=0.05$).

This difference is surprising; documentary evidence has indicated that the pre-industrial towns were polluted, overcrowded and susceptible to outbreaks of epidemics. Genetic differences between the two samples are explored as are the cultural and economic circumstances that were particular to these sites. It is suggested that the economic aspects of the urban environment, that allowed women and children to earn wages was favourable and that, in contrast the hard manual labor and food shortages characteristic of an agricultural subsistence may have had a detrimental effect on the growth of the rural children.

The balance of power in a pair. R.J. LEWIS, Biological Anthropology and Anatomy, Duke University, North Carolina 27705.

Individual fitness-maximizing strategies in nonhuman primates are often not the same and can conflict. In solitary species each individual is responsible for all principal activities: feeding, avoiding predation, finding mates and rearing offspring. In group living species, behaviors that produce public goods may be sex-dependent ("division of labor"). Pair living species were compared to determine how males and females achieve their common objectives and whether the responsibilities are balanced between the sexes. Despite the common social unit, distributions of responsibilities varied greatly across primates. For example, carrying is the responsibility of the female in the indri, the male in the dusky titi, and shared in red bellied lemurs.

Why does this variability arise? Results indicated that two processes are responsible: (1) trade-offs between males and females, especially in territorial defense and infant care, and (2) power differences within the pair caused by persistent demographic variation. In fact, the distribution of these common tasks can be used as a demonstration of the power structure of a social group.

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Health among the Poole-Rose Ossuary population as inferred from transverse lines in the left tibiae. G.A. Listi, Geography and Anthropology, LSU at Baton Rouge, LA 70803.

Transverse lines (also known as Harris lines) appear in radiographs across the medullary cavity of various bones. There are a number of nutritional and biological stressors which are associated with transverse line formation. Their association with nutritional stress has led anthropologists to use the presence or absence of transverse lines as a non-specific stress indicator in archaeological populations. The purposes of this study are to examine the prehistoric Native Canadian Poole-Rose Ossuary for the incidence of transverse lines, and to infer information about the relative health status of this Late Woodland population.

A total of 166 tibiae were analyzed in this study. The majority of tibiae (76.5%) have at least one transverse line. However, the average line frequency per tibiae is low (mean = 2.08). Chi-square analysis revealed no significant differences between line frequencies of adult and juvenile tibiae. The analysis of line length reveals that lines which extend less than half the width of the medullary cavity are the most numerous, while those which extend greater than three-fourths the width of the medullary cavity are the least numerous. The analysis of line correspondence between radiographs taken in the anteroposterior and transverse planes reveals that the longer lines (>75%) are more likely than the shorter lines (<50%) to have a corresponding mark. Nevertheless, the majority of lines have corresponding marks in the opposing view (minimum correspondence rate is 85%).

The presence and widespread occurrence of lines, the relatively low line frequency, and the distribution and pattern of line length and correspondence are interpreted as being the consequence of nutritional difficulties within the Poole-Rose population caused by decreasing crop yields and increasing crop failures due to depletion of soil nutrients. Based on the results of this study, the Poole-Rose population appeared overall to have been healthy.

Data from this study provide information to which other ossuary studies can be compared, as well as contribute to overall regional, temporal and cultural knowledge.

Segregation analysis reveals a major gene effect in compact and cancellous bone mineral density in two human populations.

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Involvement of genetic factors in determination of bone mineral density (BMD) is doubtless. However, the exact nature of genes governing BMD variation and sources for genetic determination of BMD at different parts of bone, compact and cancellous, are not completely

studied. The results of the complex segregation analyses performed in our previous study on Turkmenian sample (Livshits et al., *Human Biology*, 68:539-554, 1996), strongly supported hypothesis on the existence of a single Mendelian locus with a large effect on BMD level. The parameter estimates for both types of bone tissue were so similar that allowed us to assume a common gene effect for BMD variation of cancellous and compact bone. The objectives of the present paper were to test again the possibility of major gene control of BMD variation in ethnically different sample of pedigrees, namely Chuvasha. In addition we report here the results of a bivariate segregation analysis of compact and cancellous BMD, performed in both samples of pedigrees. The results of the present study are closely resemble the results obtained on the Turkmenian pedigrees. Likewise, the major finding of the present study is that it revealed a significant major gene effect on both cortical and cancellous BMD, when 47.2% to 39.5% of total variation in BMD was attributable to major gene effect, and clearly rejected polygenic hypothesis. Moreover, the results of bivariate segregation analysis in both Chuvasha and Turkmenian samples were also extremely similar. They lead to the acceptance of the hypothesis of single major locus with pleiotropy to both cancellous and compact bone.

The systematic position of Stw 183, an adolescent maxilla from Sterkfontein. C.A. LOCKWOOD^{1,2} and J. MOGGI-CECCHI¹. ¹Institute of Human Origins, ASU, Tempe, AZ 85287-4101. ²Palaeo-anthropology Research Group, Wits Medical School, Parktown 2193, South Africa.

The adolescent hominin maxilla Stw 183 was recovered from an area of decalcified breccia at Sterkfontein in 1984 and later assigned to Member 4. At death, the associated M3 had finished crown development and had not yet erupted, and root development of the M2 was approximately 2/3 complete. Other tooth roots were at or near completion.

The specimen's diagnostic morphology can be divided into three categories with respect to South African early hominins: 1) traits shared exclusively with *Australopithecus robustus*, 2) traits shared exclusively with *A. africanus*, and 3) traits shared with adults of *A. africanus* and immature specimens of *A. robustus*. Morphology in the first category includes a laterally rounded inferior orbital margin, a shallow maxillary trigon, a broad, flat anterior pillar, a close approximation of the premolar and molar cusp apices, and an expanded hypocone on the upper molars. Morphology in the second category includes palatal thickness, the form of the nasal entrance, the proportions of the incisors and premolars relative to M2, and the inferred degree of alveolar prognathism. Morphology in the third category includes the overall metrical similarity between Stw 183 and SK 52 (an adolescent of *A. robustus*), such as the low, broad maxilla and high infraorbital foramen.

The dental characteristics of Stw 183 are shared with a group of specimens from Sterkfontein. Stw 183 was probably conspecific with these individuals, if not all Member 4

specimens, but this similarity cannot be verified using facial morphology because the sample is fragmentary. We further note that dental development in Stw 183 is more compatible with the modern human pattern than that of the chimpanzee. This contrasts with previous reports for *A. africanus*.

The mosaic pattern of morphology in Stw 183 lends strength to previous suggestions of taxonomic diversity in the Sterkfontein Member 4 deposit. Alternatively, if it is kept within the hypodigm of *A. africanus*, Stw 183 has novel implications for the ontogeny of that species.

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Morphometric segregation of commingled remains using the femoral head and acetabulum. M. R. LONDON and D. R. HUNT, Department of Anthropology, National Museum of Natural History, Washington, DC 20560.

Sorting of commingled remains continues to be an issue for physical anthropologists working on ossuary sites or mass disasters. While many bones can be reassociated using visual characteristics and taphonomic changes, these methods may be inadequate when the bones are fragmentary and/or when the taphonomic changes are similar in all individuals. In a pilot study, London and Curran (1986) found a significant correlation between standard measurements of the femoral head and the vertical and horizontal diameters of the acetabulum as described in Davivongs (1963). The femoral and acetabular measurements were well correlated, suggesting that these measurements could be used to separate individuals in commingled populations effectively.

To test this hypothesis, 129 individuals from the Terry Collection housed in the National Museum of Natural History (NMNH) were measured following the London and Curran protocol. The acetabular measurements were not readily reproducible in the Terry Collection sample. Postmortem damage and arthritic lipping made the external margins of the joint difficult to assess. New measurements were developed which excluded these arthritic or postmortem changes at the joint margins, and which reflected the functional morphology of the hip more accurately. The new measurements are also more easily standardized.

The revised measurements were analyzed for differences between antimeres, sexes, and populations (American Blacks and Whites). Age was assessed as a contributing factor to variation. The revised measurements support the London and Curran conclusion that the highest correlation for the skeletal features studied is found between the transverse diameter of the femoral head and the vertical diameter of the acetabulum.

Using this new method, a sample set of the femora and innominates of 30 "unknown" individuals from the Huntington Collection at NMNH was subjected to a blind test to evaluate its accuracy. Commingled remains were visually segregated by size and taphonomic changes, by using the measurements of the femoral head and acetabulum, and by using a combination of the visual and morphometric criteria. These tests showed that the probability of correctly reassociating femora and innominates from the same individual was highest using a combination of visual sorting and metric analysis.

Pathology at the Hampstead Hill Site: Health in an early 19th century U.S. population. A.M. LUBENSKY, C.B. RUFF, M.F. TEAFORD
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Hampstead Hill is a unique 19th century site in Baltimore that includes two contemporary populations contrasting in economic and social status. No other comparable excavated collection exists in Maryland. Hampstead Hill consists of the Christ Church Episcopalian burial grounds (1800-1855) and the "Old" Potter's Field (1793-1832). The Christ Church grounds housed congregation members, while Potter's Field was used for the burial of the indigent and unclaimed. During this time period, Baltimore was rapidly growing and suffered from severe yellow fever epidemics. While yellow fever produces no bony defects, other pathologies may indicate how these two groups fared during a stressful period of history.

A total of 164 burials were examined macroscopically. Any lytic lesions, bone growths, healed or unhealed fractures, or porotic hyperostosis were noted and described. Joint surfaces were examined for osteoarthritis and graded for severity. All available teeth were examined for caries and enamel defects. Caries were noted for number and general size, and defects were classified as hypoplastic pits or striations. Chi-square analysis was performed with SYSTAT 5.0 to test for significance of pathology incidence between Christ Church and Potter's Field, and between males and females.

Our results indicate that individuals from the Christ Church sample, and males overall, generally had higher incidences of pathology. Males had a significantly higher percentage of hip arthritis and Christ Church had a significantly higher percentage of hypoplastic striations on the mandibular incisors. However, on the whole, both samples show relatively low incidences of skeletal pathology when compared to other broadly contemporaneous samples.

Physical Properties of Foods in *Alouatta palliata*. P.W. LUCAS, Anatomy, Hong Kong U., M.F. TEAFORD, Cell Biol. & Anatomy, Johns Hopkins U., P.S. UNGAR, Anthropology, U. of Arkansas, K.E. GLANDER, Duke University Primate Center.

Recent work has suggested that primate species often eat foods of different physical properties. This may in turn have implications for the tooth structure and wear in those species. As the resources available to primates may vary significantly from one habitat to another, food choice, and thus dental function, may also vary within species. The purpose of this study was to examine the physical properties of leaves eaten by *Alouatta palliata* from three different social groups at Hda. La Pacifica in Costa Rica.

Leaves were sampled from the ranges of social

groups living in progressively more diverse / bountiful microhabitats. Samples from 88 feeding events on leaves ($n = 22$ to 34 per group) were collected during July, 1997. Specimens were collected in the same trees in which the animals fed. Samples were taken on the same day, from the same height in the canopy and chosen to match the degree of maturity of leaves selected by the primates.

Toughness of leaves was estimated using a scissors cutting test as described by Darvell et al. (1996). Ranked data ANOVA's were used to compare the groups for leaf toughness across the: 1) the least-tough path in lamina between secondary veins, 2) the apical third of leaf, and 3) the basal third of leaf. The source of significant variation ($\alpha = .017$) was determined using a Bonferroni multiple comparisons test.

Results indicate that the monkeys in the least diverse forest, those from social Group 1, selected leaves with the toughest basal thirds -- significantly tougher than those taken by social Group 2. Both Group 1 and Group 2 are from non-riverine microhabitats, Group 1 has a smaller home range, with a lesser diversity of preferred food resources. Group 1 primates may therefore be forced to consume some less desirable foods that are more difficult to chew (i.e., higher fracture toughness). If so, differences in resource availability may lead to differences in the material properties of foods eaten by a given primate species. Supported by NSF grant # SBR 9601766.

Mating behavior in wild tufted capuchins (*Cebus apella nigrinus*) in Brazil's Atlantic forest. J.W. LYNCH, Anthropology Dept., UW-Madison, Madison WI 53706.

Tufted capuchins (*Cebus apella*) are known for their unusual mating behavior, with the female following the male for hours or days before he consents to mate with her. This study documents the estrus and mating behaviors in one tufted capuchin troop at the Caratinga Biological Station in Minas Gerais, Brazil from September 1996 to August 1997. Group size ranged from 24 to 28 individuals. Behavioral data were recorded using scan samples, focal animal follows, and *ad libitum* techniques.

Five males and 11 females displayed mating behavior. A total of 32 copulatory sequences with male mounts, and 10 partial sequences including female mounts or characteristic post-copulation displays, were observed. These behaviors were concentrated in the early dry season. All parous females came into behavioral estrus earlier in the mating season than nulliparous females. Parous females were also more likely to display more consecutive days of conspicuous proceptive behavior during estrus. Estrous cycle length ranged from 12 days to 32 days, with a mean cycle length of 21.5 ± 5.5 days ($n=13$). Multiple females were often in estrus concurrently.

All adult males and one subadult male were observed copulating or in post-copulatory display. The alpha male and another adult male performed 11 copulation bouts each, together accounting for 68% of the matings. Four copulations by non-alpha males were interrupted by other males. Non-agonistic sequential matings also occurred, in which one female mated with 2 or more males in rapid succession. Capuchin copulations can be categorized in 3 types: the single mount "quickie", the "sneak" involving little courtship but extended post-copulatory display, and the "consortship" with hours or days of close proximity of the mating pair. Analyses suggest that capuchin mating strategies are highly variable and reflect social and reproductive status.

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Skull reconstruction by stereolithography and non-invasive archaeology of 7000 year-old human remains. N. LYNNERUP, H. HJALGRIM. Laboratory of Biological Anthropology, Institute of Forensic Medicine. University of Copenhagen, Denmark.

This presentation describes the techniques of three dimensional imaging and stereolithography. The anthropological potentials are illustrated by an examination of an Egyptian mummy and a 7,000 year-old human mandible still embedded in soil matrix.

The mummy was decorated with the portrait of a young man, presumably depicting the embalmed individual. The mummy portrait is considered one of the finest of its kind in the world, and analysis of the human remains within had to be completely non-destructive. On the basis of computerized tomography of the head region of the mummy a polymeric cast of the skull was produced by means of stereolithography. This technique uses photosensitive resins, which polymerize, and thus solidify, when "hit" by a laserbeam. The laserbeam is guided by the 3-dimensional structure visualized by a computer. The model (size 1:1) exhibited a vast amount of not only superficial details, e.g. sutural patterns, but due to the modelling technique, also internal details like frontal sinus configuration and dental root morphology.

The mandible was recovered in a block from an excavation in Syria, thus retaining it in the soil matrix. The excavated block was CT-scanned and the skeletal material was rendered in three dimensions. This formed the basis for a stereolithographic model of the mandible, which was used for physical and dental anthropological studies. It was possible to observe morphological characteristics, measure several standard physical anthropological variables and describe the gross dental status of the individual. This allowed for a tentative evaluation of sex (probably male) and age (adult, probably 25-50 years old).

This project shows that stereolithographic modelling can produce accurate and detailed 1:1 size models of a given specimen. Thus, this technique can be used to produce copies of otherwise not accessible human remains.

Ethnicity and gene flow in Limón, Costa Rica. L. Madrigal and B. Ware. Department of Anthropology, University of South Florida. Tampa, FL 33620

The study of ethnic or cultural barriers to gene flow has a long history in biological anthropology. Generally, research has focused on the genetic differences among several ethnic groups located over a large geographical area. A review of the literature however, reveals a virtually non-existent record on research on cultural barriers to gene flow between ethnic groups which live at the same settlement. In this paper such a situation is explored in the Limón region of Costa Rica. The issue of differential gene flow between the two ethnic groups is addressed, as well as how this gene flow is reflected in the ethnic groups' heterozygosity estimates.

Blood samples were obtained from a total of 375 individuals at the Limón hospital, and at door-to-door visits. The samples were analyzed for hemoglobin, G-6PD and Gcl, Bf, ACP, PGM1, and PLG. The subjects were also interviewed, and asked to ethnically/racially classify themselves. The only two terms chosen by the subjects were Black (246 individuals) and White (129 individuals). The subjects were also classified according to the language of their surnames, into the English or Spanish ethnic group. For each group, heterozygosity at loci found to be in equilibrium (Nei and Roychoudhury, 1974), and the overall heterozygosity was computed.

With virtually no exceptions, subjects who classified themselves as Black had English last names, and subjects who classified themselves as White had Spanish last names. This provides us with a clear manner to define the ethnicity of the subjects, for purposes of computing gene frequencies and heterozygosities.

The heterozygosities for the Afro-Limonense group were GCI=0.5009, BF=0.5308, ACP=0.3584, PGM1=0.5480, PLG=0.36045. The heterozygosities for the Afro-Limonense group were BF=0.3871, ACP=0.4243, PGM1=0.6116, PLG=0.3502.

The importance of ethnicity, as seen in surnames and self-classification, in relation to genetic make up is further discussed.

Treponematoses in Mexico. J. MANSILLA, C. PIJOAN. Antropología Física, Instituto Nacional de Antropología e Historia, Mexico 11560 DF.

If treponematoses spread all over the world with early modern humans, evidence from ancient Mexico will test this hypothesis. The paleopathology of ancient Mexico is evaluated in samples from the Prehispanic to the Colonial period. The ecological and sociocultural contexts of eight population samples are discussed from an epidemiological point of view. Differential diagnosis of the four treponematoses syndromes is taken into account. We found evidence for at least two of the syndromes: endemic and venereal syphilis. We analyzed all the reported cases, with particular interest in La Cueva de la Candelaria, Coahuila. In this cave

remains of 113 mixed individuals were found. The bones had been mixed by looters, making this an ossuary. The lesions found in this sample strongly suggest venereal syphilis.

More than the elite meet to eat: Meat distribution at hunts by wild chimpanzees (*Pan troglodytes*). L.F. MARCHANT, Anthropology, and W.C. MCGREW, Anthropology and Zoology, Miami University, Oxford, OH 45056.

Wild chimpanzees are now well-known as hunters: They seek, stalk, pursue, capture and kill small to medium-sized mammalian prey, usually cercopithecoid monkeys. Less is established about chimpanzees as processors, distributors, recipients, and consumers of the body parts of the prey. We present videographic footage from seven hunts by the chimpanzees (*Pan troglodytes schweinfurthii*) of M-Group in the Mahale Mountains National Park, Tanzania. The data were collected between September and December, 1996; all the prey were red colobus monkeys (*Procolobus badius lephrosceles*).

Although the main carcass was usually controlled by the alpha male and his closest associate (beta male), smaller amounts of meat were widely distributed throughout the 50-member unit-group. Older, dominant females took meat directly, while younger, lower-ranking females begged or offered copulation for it. Other adult or immature but independent individuals scavenged for remnants on the vegetation or ground, taking even the tiniest amounts, such as drops of blood. Dependent infants and juveniles scrounged left-overs from their mothers. Thus, a kill was a community-wide event, one of few that brought together its usually dispersed members, so that its ramifications far exceeded its nutritional function.

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The application of computed tomography to paleoneurology: An example from the study of brain evolution in fossil Cetaceans. L. MARINO, Department of Biology, Emory University at Atlanta, GA 30322.

In order to address questions about cognitive and behavioral evolution in paleobiology one must rely upon preserved manifestations of behavior (e.g., artifacts), inferences about behavioral capacities from functional morphological analyses (e.g., skeletal mechanics), and examination of cranial morphology to measure brain size and structure (i.e. paleoneurology).

This abstract reports on a study that exemplifies how questions about the evolution of the brain and intelligence can be addressed by applying Computed Tomography (CT) to study brain size and structure. Specifically, endocranial volume and morphology were measured in fossilized cetaceans (dolphins and whales) from CT scans used in conjunction with an image processing and analysis program. This report describes the method utilized and initial results, with examples of scanned images shown. An emphasis will be placed on contrasting CT with other methods of studying brain evolution from fossilized material and outlining the distinct advantages of CT over other methods.

Breathing the air in the later Pleistocene: Examination of nasal complex morphology in the Broken Hill and Gibraltar 1 crania.

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The morphology of the nose and paranasal sinuses (nasal complex) among primates is an area of growing interest (e.g., Koppe, 1996; Rae, 1997; Ward, 1997). Studies of the nasal complex in extant human populations have focused largely on external bony parameters - with little attention to the internal milieu - to assess ecophysiological adaptations to climate. While increased attention has been focused on extant groups, few studies have explored the region in fossil hominids.

Crania of Broken Hill (Kabwe, Zambia) and Gibraltar 1 (Forbes' Quarry) were studied at the British Museum, London to assess their nasal complex. Assessment of internal anatomy was assisted via transillumination. A sample of 82 adult human crania (representing both sexes) and reflecting a range of extant regional populations (including eastern Europeans, Eskimo and San) were studied. Both external linear measures (e.g., nasal height, breadth) and internal volumes (e.g., maxillary sinus volumes) were assessed. Endocranial volumes were used to standardize maxillary sinus size (see Marquez et al., 1995). Due to the condition of the fossils only right maxillary sinus volumes were collected.

Results indicate that while both specimens exhibited extensive sinusal pneumatization, Broken Hill presented particularly large ethmoid sinuses, while Gibraltar 1 had an expansive maxillary sinus complex. Of particular note in Gibraltar 1 was the presence of a medially projecting rim of bone just within the piriform aperture (first reported by Schwartz & Tattersall, 1996). This nasal projection was not found in the extant sample. Although its function is unclear (e.g., may increase surface area for respiratory epithelium or create airflow turbulence) this morphology suggests a respiratory role. Volumetric assessment of the sinuses shows Gibraltar 1 to fall at the limit of the extant human range, with Broken Hill being identified within it. Taken together, our morphological and volumetric assessments suggest that the nasal complex in Broken Hill lies closer to the condition found in extant populations, while Gibraltar 1 is at the periphery, or outside the range, exhibited by living humans.

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The American Southwest: Living on the Edge of Existence. D.L.MARTIN, Hampshire College, Amherst, MA 01002, A.L.W. STODDER, Field Museum of Natural History, Chicago, IL 60605, A.H. GOODMAN, Hampshire College, and D. REFF, Comparative Studies, OSU, Columbus, OH 43210

An impressive wealth of data exists for many aspects of Southwest prehistory but what has been lacking from this literature is a more comparative and regional synthesis of health. The Health, Economics and Anthropology (HEA) research agenda was to bring together interdisciplinary teams that could examine patterns of health and nutrition spanning hundreds of years using comparable data sets in major regions throughout North and South America.

The HEA "health index" is the sum of the quality adjusted life years lived by an individual, and thus describes the combined effects of morbidity and mortality. In comparing the combined data sets, the data demonstrate that individuals in the Southwest carry a morbidity burden higher than most of the other data sets. Mortality is high and morbidity is ubiquitous. The combination of these two related processes resulted in a "health index" score of 16.5. The mean age at death of approximately 24 years suggests that southwest groups were on the lower end of the mortality spectrum when compared with all other data sets.

These data suggest that the people in the Southwest, when compared with many other prehistoric and protohistoric groups from North and South America, suffered constant and endemic health problems. Although much of the previously published archaeological and historical data suggested that, for a variety of cultural, economic, political and environmental reasons the Southwest groups were a more stressed population, the HEA data support these hypotheses. Comparison of comparable data across major data sets provides a dimension of analysis in the Southwest not previously possible and as such, presents important additional information in the interpretation of health in the American Southwest prior to colonization.

Primate brain evolution: the maternal contribution. R.D.MARTIN, Anthropological Institute, University of Zürich, CH-8057 ZÜRICH

Basal metabolic rate and brain size show similar patterns of scaling to body mass in mammals. This has led to proposals (collectively labelled "expensive tissue hypotheses") that energetic cost imposes constraints on brain size. Most hypotheses suggest that energy availability directly limits brain size in the individual adult. However, there is far more residual variation in brain size than in basal metabolic rate. This, combined with evidence that brain development is crucial, prompted my formulation of the "maternal energy hypothesis" (Martin, 1981). It was postulated that the mother's energy resources constrain development of the brain during intra-uterine growth and lactation. A large proportion of brain growth is achieved by weaning. Indirect association between a mother's metabolism and the adult brain size of her offspring would explain the general similarity in

scaling of brain size and basal metabolism, while intervening variables (e.g. gestation, lactation) would explain the greater residual variation in brain size.

The maternal energy hypothesis has been questioned from two directions. McNab & Eisenberg (1989) found no significant correlation between residual values for brain size and basal metabolic rate, but there were flaws in that study: the statistical test was inappropriate; the sample was unrepresentative; potential bias due to phylogenetic relatedness was not considered. Appropriate analysis of a balanced sample of 51 placental mammal species reveals that residuals for brain size and basal metabolic rate are strongly correlated. The correlation is improved by including residual values for gestation period (predicted only by the maternal energy hypothesis). That hypothesis has also been challenged by Pagel & Harvey (1988, 1990), primarily because litter-size was not included. The influence of litter size depends on whether the maternal energy constraint applies at the life-history level or the physiological level: the latter seems to dominate. If litter size is eliminated by confining analysis to mammals with single births, the predictions of the hypothesis are confirmed.

Canine form in *Cebus*. T.J. MASTERSON, Department of Biology, James Madison University, Harrisonburg, VA 22807.

Canine dimorphism and interspecific canine form is investigated in adult specimens from four capuchin species (*Cebus albifrons*, *C. apella*, *C. capucinus*, and *C. olivaceus*). Six canine variables are used. Various univariate and multivariate statistics are used to test several hypotheses that are based upon the finding that canine dimorphism in New World primates is strongly associated with intermale competition (Kay et al., 1988; Greenfield, 1992; Playcan and van Schaik, 1992, 1994).

Results from both the unpaired t-tests and indices of canine dimorphism corroborate the hypothesis that males of each species possess significantly larger canines. Large male canines are especially prominent in two variables, maxillary and mandibular canine height.

Due to interspecific differences in levels of intermale aggression (See Masterson, 1996), it was predicted that *C. apella* and *C. olivaceus* should possess larger degrees of canine dimorphism than *C. capucinus* and *C. albifrons*. Results from Greene's (1989) t-test do not support this hypothesis. No interspecific differences in degree of canine dimorphism are indicated by this test. By contrast, results of Tukey's multiple comparison tests performed on the all male and all female samples provide some support for this hypothesis. Male *C. apella* possess the largest linear distance in all variables, whereas male *C. albifrons* possess the smallest linear distance in each variable. *Cebus capucinus* and *C. olivaceus* are very similar in size and are intermediate in linear distance between *C. apella* and *C. albifrons*. Similar results are present among the female capuchins.

Results of the various discriminant function analyses provide some interesting information on interspecific canine form. All four DFAs using sex as the factor are highly significant. All indicate that maxillary and mandibular canine height are the most powerful discriminators. Sex classification is 100% correct in each DFA. Similar results are observed when the DFA is run on the entire sample using sex as the factor. Differences

are revealed when comparing the all male and all female DFAs. While both DFAs are significant, the female DFA correctly classifies 100% of the specimens into their proper species. By comparison, the male DFA correctly classifies only 68% of the *C. albifrons* specimens, 80% of *C. apella* specimens, 53% of *C. capucinus* specimens, and 42% of *C. olivaceus* specimens into their proper species. These analyses suggest that intermale competition likely underlies canine dimorphism in the four capuchins; however, other selective factors may contribute in determining interspecific canine form.

New data about the orientation of the infraorbital surfaces in Neandertals and anatomically modern humans. B. MAUREILLE and F. HOUËT, URA 376 CNRS, Laboratory of Anthropology, University Bordeaux I, Av. of Faculties, 33405 Talence cedex, FRANCE.

In 1991 E. Trinkaus underlined that the metrical variability of the spatial orientation of the Neandertal "infraorbital plate" was till unknown. Clearly, the zygomatic angle (SSA, Howells 1973) is not the ideal measurement to determine the relative parasagittal orientation of the infraorbital surface when you want to compare the upper face morphology of Neandertals and modern humans.

To try to understand the main architectural traits of the Neandertal face and eventually their causes, we have determined the spatial position of classical and new facial landmarks in a cranial cartesian system of référence. Unfortunately this new system allows only the study of the best preserved fossils : La Chapelle-aux-Saints, Guattari 1, Petralona and Qafzeh 6. They have been compared to 80 modern humans.

The determination of the cartesian coordinates of the points has allowed us to find new angles which are clearly pertinent to represent the orientation of infraorbital surface segments.

Thus it appears that the facial morphological differences between Neandertals and modern humans is essentially the consequence two factors : an anterior projection of the medial part of the infraorbital surface of the maxilla and of a postero-medial position of the zygomatico-maxillary suture (or the lateral part of the infraorbital surface of the maxilla). For the latter, the reason of such a difference would be more related to ontogenetical process than functional one as the antero-medial extension of the masseter muscle insertion shows it.

Human remains as offerings at four Maya centers D.B.S. MAXWELL, Statistical Research, Inc., Redlands, CA 92373 and Department of Anthropology, University of Arizona, Tucson, AZ 85721.

Human skeletal remains are occasionally found as inclusions in offertory caches in Maya

centers. Patterns of human remains useage are correlated with offering location and local political history for four sites in the Peten region: Tikal, Uaxactun, Seibal, and Altar de Sacrificios. Early Classic offerings are consistent with decapitations, containing skulls and cervical vertebrae, while later offerings more resemble disturbed burials, containing other areas of the skeleton. At Tikal, a peculiar phenomenon of including fingers with caches coincides both with Caracol's rise to power, and with a similar phenomenon at this Belize center.

Genetic Markers as indicators of familial relationships at Spiro Mounds, Oklahoma. A.T. Mayes, Biological Anthropology, University of Colorado, Boulder, CO 80309

The individuals from the Spiro Mounds of Oklahoma exhibit high rates of rare dental genetic markers. Dental genetic markers provide a means of addressing questions of biological affinity including familial relationships. Dental traits that appear to be inherited are of particular interest due to their slow rate of change, growth patterns, and consistency. This makes them useful tools in furthering our understanding of prehistoric populations. These traits can be exaggerations of normal variation in enamel, shape and size differences of individual tooth crowns and roots, or even additional teeth. Peck, Peck and Attia (1993) discuss five characteristics which can be concluded as evidence of polygenic traits: 1) Increased frequency of dental anomalies, 2) Bilateral occurrence in a high percentage of cases, 3) Familial occurrence, 4) Different frequencies of occurrence likely in different populations, 5) Differences between sex.

Among the Spiro individuals, ectopic enamel is the most common polygenic trait (enamel extensions, 66%; enamel pearls, 22%) and is seen in combination with at least one other genetic marker expressed in this population, as well as occurring alone. Out of 11 teeth expressing dens in dente, observable without radiographs, 14 have enamel extensions, 2 enamel pearls, and lingual and labial shoveling were also observed. Single traits are not only considered for their presence or absence, but for their degree of expression. In addition, when looking at several traits at the same time, degrees of expression are considered as well.

Observed traits from the Spiro Mound individuals follow the pattern of characteristics associated with polygenic traits; therefore, it can be inferred that the Spiro population consists of closely related family units.

Paleodemography: research findings and methodological implications from an analysis of more than thirty Western Hemisphere skeletal populations. ROBERT McCAA, Department of History, University of Minnesota, Minneapolis, MN 55455

The Health and Nutrition in the Western Hemisphere database contains more than 8,000 skeletons from some

thirty sites representing three ethno-racial populations and ranging over eight millennia. A comparative paleodemographic analysis using a variety of methods yields new insights on millennial long transformations of living conditions in the Western Hemisphere. The database reveals strengths and weaknesses of paleodemographic methods that may not be noticed when research is restricted to only a few sites limited in time and space.

Cranial base angulation and facial growth in *Homo*: A comparative longitudinal and intertaxonomic study. R.C. McCARTHY, Rutgers University, New Brunswick, NJ 08903

Neandertals uniquely combine a large brain with a cranial base that is significantly less flexed than that of Pleistocene and Holocene *Homo sapiens*. Because cranial base flexion occurs within the first two years after birth in humans, it is useful to examine the developmental bases for these variations that occur early in cranial ontogeny, as well as to examine intertaxonomic comparisons of adults. Accordingly, this study investigates the ontogeny of cranial base angulation (CBA) in relation to facial growth and brain growth using longitudinal radiographic data from *Homo sapiens* and *Cebus sp.* These data are compared to variations in CBA, cranial size and cranial base length in adult hominids and other primate taxa.

The two species have markedly different CBA ontogenies. The human cranial base flexes during the first one-third of neural growth (by 2 years), and CBA does not change significantly thereafter through 18 years of age. In contrast, the *Cebus* cranial base does not change significantly until 24 weeks, again approximately one-third through the neural growth trajectory. Thereafter the *Cebus* cranial base extends considerably in a skeletal growth trajectory along with growth of the face.

It is proposed that greater angulation of the cranial base typical of *Homo sapiens* is caused by a combination of a large brain and relatively short sphenoid body, which positions the face under the neurocranium. Conversely, the long sphenoid body relative to cranial base length of *Cebus* positions the back of the face further forward, contributing to facial projection. Although Neandertals are as equivalently encephalized as *Homo sapiens* and probably solely flex their cranial bases, they also have long sphenoid bodies relative to cranial base length, like *Cebus*, which may account for their slightly less flexed cranial bases. This hypothesis is further tested using comparisons among adult primate and hominid taxa.

Surface Remodeling of the Chimpanzee Subnasal Region and its Relevance to Hominid Craniofacial Evolution. M.A. McCOLLUM, Departments of Anatomy and Oral and Maxillofacial Surgery, Case Western Reserve University, Cleveland OH 44106.

Surface remodeling of the subnasal region is known to differ among primates. For example, in the prognathic macaque the full extent of the nasoalveolar clivus is depository throughout development. In comparison, this same region is entirely resorptive in orthognathic *Homo sapiens* and *Paranthropus*. Although the suggestion has been made that clival resorption in the latter two groups is

not entirely homologous, there has yet to be any formal analysis of this proposition. Clival remodeling patterns are unknown in all other primates except *Cercocebus* and the chimpanzee, and the latter is known only from a sample of six subadults of the same dental age. Understanding the basis of clival remodeling in hominid taxa will require a much larger comparative sample.

This analysis documents subnasal remodeling in a mixed-sex sample of subadult chimpanzees ($n = 20$) from the Cleveland Museum of Natural History. The ontogenetic series was age-seriated on the basis of relative incisor, canine and first molar development. High resolution epoxy replicas of the subadult subnasal region were examined under the SEM and the activity states of cortical bone during growth were distinguished by their surface topographies.

Results demonstrate that the chimpanzee nasopalveolar clivus is largely depository throughout much of postnatal development and that the development and eruption of the permanent canines influences the relative speed of clival deposition in localized areas. That portion of the premaxilla that contributes to the nasal cavity floor was found to be resorptive in all groups. However, in a number of specimens the nasal resorptive field was found to continue down the nasopalveolar clivus to an area overlying the central incisor alveolus. Significantly, the variable presence of resorptive fields along the chimpanzee clivus renders this taxon an appropriate comparative analogue for the evolution of alternative models of clival development in early hominid taxa.

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Peopling of the New World: A molecular perspective. J. MCCOMB, University of Kansas, R. J. MITCHELL, La Trobe University, M.S. SCHANFIELD, and M.H. CRAWFORD, University of Kansas, KS 66045

The peopling of the New World has been investigated via a number of molecular markers including mtDNA, the Y-chromosome, classical markers and viral strains. The numerous studies have often yielded conflicting hypotheses concerning the origins of the Native Americans which vary according to the markers examined. Central to these studies have been questions about the number of migrations and the timing of each migration. In addition, a number of researchers have explored which Asian groups are the most genetically similar to Native American populations in an effort to reconstruct the founding gene pool of the American Indians.

To date, there has been few studies into the origins of Native Americans which utilize highly repetitive DNA sequences such as VNTRs and STRs. We have explored the question of Native American origins using the following highly repetitive DNA loci: FGA, THO1, VWA, CSF1PO, TPOX, D7S104, D8S1179, D11S129, D18S17.1, D18S51, D20S15, D21S11 and D21S12. Examining the frequency of

alleles from each system, we have compared five Asian groups to a population of Native Americans to determine population affinities among the different groups. Preliminary results indicate that the PCR based loci give a different evolutionary perspective from the non-PCR based loci, which may be a function of the markers studied. Ultimately, to further answer which Asian groups most resemble the Native American populations we propose that a genomic scan of the nuclear chromosomes may produce a more parsimonious result than previous methods because it examines the contribution of all of the nuclear DNA rather than a select part.

Functional and phylogenetic analysis of the distal radius of *Kenyapithecus*, with comments on the origin of the African great ape and human clade. M.L. McCROSSIN, B.R. BENEFIT, and S.N. GITAU, Department of Anthropology, Southern Illinois University, Carbondale, IL 62901.

Although crucial to reconstructing forelimb kinematics and phylogenetic affinities, the inferior radioulnar joint of Miocene catarrhines has been known only for *Proconsul* from Site R114 on Rusinga Island (Napier & Davis, 1959) and *Pliopithecus* from Neudorf an der March (Zapfe, 1960). A distal radius of *Kenyapithecus* collected from Maboko Island in 1997 provides therefore the first knowledge of the inferior radioulnar joint for a large-bodied hominoid from the middle-late Miocene.

The distal radius of *Kenyapithecus* strongly resembles modern hominoids in several features. The medial margin of the *Kenyapithecus* distal radius forms a dorsoventrally crescentic and concave articular embrasure for the distal ulna, allowing an extensive range of pronation and supination at the inferior radioulnar joint. Despite erosion of the dorsal tubercle, lateral margin, and styloid process, the radius of *Kenyapithecus* appears to exhibit the marked volar slant of the distal end that distinguishes modern hominoids, especially the African great apes, from *Proconsul*, *Pliopithecus*, cercopithecoids, and ceboids (Jenkins & Fleagle, 1975). The articular surfaces for the scaphoid and lunate are deeply concave, unlike the relatively flat surfaces of *Proconsul*, *Pliopithecus*, and monkeys (both catarrhine and platyrrhine). These features are congruent with inferences of a modern hominoid-like range of pronation and supination at the superior radioulnar joint of *Kenyapithecus* based on the laterally facing radial notch of a proximal ulna from Baragoi (Rose et al., 1996).

Together with previously identified character states of the subnasal pattern, mandibular symphysis, deciduous dentition, arm, hand, ankle, and intermembral proportions (McCrossin, 1994, 1997; McCrossin & Benefit, 1993, 1994, 1997), the distal radius provides further evidence that *Kenyapithecus* is the oldest known member of the African great ape and human clade. These results refute notions that *Kenyapithecus* retains *Proconsul*-like adaptations and phylogenetic relationships as well as suggestions of a Eurasian origin of the great ape and human clade.